

Development of HAAQ: Hands-Free Attendance Archive using QR Code

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Abstract: This study aimed to develop a system that utilizes a Raspberry Pi and QR Code scanner in taking employee attendance, create a database to save the employee data, design a user interface for the system, and evaluate the system in terms of its usability. This study utilized a descriptive-developmental research design. The Raspberry Pi served as the server for the system and the LAMP software stack was utilized for the database. Furthermore, Python was used as the programming language in developing the user-interface as well as the back-end interface. The study utilized the System Development Life Cycle Waterfall Method as guide in the development and evaluation process. The questionnaire checklist by John Brooke (1986) was utilized to evaluate the system's usability. Thirty-six faculty and staff of the Iloilo State College of Fisheries – San Enrique Campus were chosen randomly to evaluate the system. The data gathered were tabulated and analyzed using the System Usability Scale and yielded a result of 95.20833 which falls in the 96-100 Percentile Range, described as 'Best Imaginable'. The system received a Net Promoter Score of 'Promoter' and 'Acceptable' in terms of its usability. The study was conducted at Iloilo State College of Fisheries – San Enrique Campus from April 2022 to July 2022.

Keywords: Attendance, Archive, QR Code, Raspberry Pi

1. Introduction

As the world slowly starts to adopt to the new normal brought about by the COVID-19 pandemic, new protocols are also being implemented. Although we are now experiencing some semblance of normalcy, protocols like wearing of facemasks and limited physical contact are still being strictly followed. To this end, the IT industry has fervently led the way in developing new systems that can provide normal services that adheres to these strict physical distancing protocols.

QR Code is one of the most widely used mediums of data storage. It is portable, easy to store, and can be generated and replicated easily. With the proliferation of smartphones, scanning and reading of QR Code is an easy means of data transfer. On that note, even the Philippines have resorted to utilizing QR Code in the storage of individual Vaccination Certification information (Baclig, 2021). Regardless of the fact that a QR Code can be easily replicated, the security risks associated with the medium come from the application rather than the code themselves.

As with almost all institutions, logging of attendance is important. However, due to this limited physical contact protocols, common means of attendance logging like logbooks and biometrics are now prohibited. At the Iloilo State College of Fisheries – San Enrique Campus, the Institution have reverted back to the manual logging of

attendance to a logbook because of the risks imposed by physical contact due to the COVID-19 pandemic. This particular practice is redundant and time consuming since the faculty and staff are required to manually log into a logbook, and then manually copy their login and logout time to their respective Daily Time Record (DTR) form at the end of the month. It is also an avenue for delay since there is only one logbook and the faculty and staff have to wait for their turn to use it should they need it. Manually filling out an attendance logbook opens up the possibility for duplicity, such that late employees can simply write a false time in order to conceal the fact that they are tardy.

The issues regarding the manual logging of attendance and the risk of physical contact due to COVID-19 can be easily remedied by a lot of IT applications, one of which is the utilization of QR Codes. An attendance system that utilizes QR Codes will eliminate the need for manual logging of attendances to a logbook. Additionally, digital attendance monitoring systems have embedded clocks which cannot be altered or tampered with. Which means that employees cannot tamper with their time records since it is the system that automatically logs the time of their arrival or departure. Moreover, a database system can be utilized in order to remedy the redundant practice of manually checking the attendance logbook and writing it on a DTR.

One study (Nakamoto, I., et.al., 2020) have concluded that using a QR Code-based system have substantially controlled the spread of COVID-19 in the Fujian Province in China. Since QR Codes can be scanned from a distance, users can maintain physical distancing and contact.

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In terms of its application in taking student attendance, another study (Rahmawati, D., et.al., 2019) have found out that QR Code is an effective means of taking student attendances. It eliminates the redundant filling up of logbooks, and most importantly a database system secures the attendance data for easy and streamlined access.

This project was conceived after several dialogues with a number of faculty and staff of Iloilo State College of Fisheries – San Enrique Campus regarding their concern on how to implement an attendance system that follows physical distancing protocols. ISCOF-SEC is in the process of preparing the school for the limited face-to-face program. One of the many requirements is an attendance logging system that adheres to limited physical contact with objects, in this context it refers to the repeated contact with the logbook.

1.2 Objectives of the Subjects

This study aimed to develop a Hands-Free Attendance Archive using QR code and evaluate its usability. Specifically, this study aimed to:

1. utilize QR Code scanner in generating attendance logs for Hands-free Attendance Archive;
2. integrate a Raspberry Pi 4B into the Hands-free Attendance Archive;
3. create a database for the Hands-free Attendance Archive;
4. design a user-interface for the Hands-free Attendance Archive;
5. determine the acceptability of the developed system in terms of its usability.

1.3 Conceptual Framework

The conceptual framework of this study used the Input-Process-Output (IPO) Diagram. The researcher gathered data in order to conceptualize the problems to be addressed. Using the System Development Life Cycle (SDLC), the researcher was able to design, develop, test, and deploy a system that have addressed the problems that were determined during the data gathering phase. The Hands-free Attendance Archive using QR Code system served as the output in this case. The output system was subjected to evaluation of its usability.

In order to ensure that the core problems are addressed, the researcher designed the system so that it can Utilize, Integrate, Create, and Design a system based on the Input as stated in the Conceptual Framework. These records will be saved into a database for easy storage and retrieval. Finally, using these Inputs and Processes, the researcher was able to come up with the Hands-free Attendance Archive using QR Code as the output.

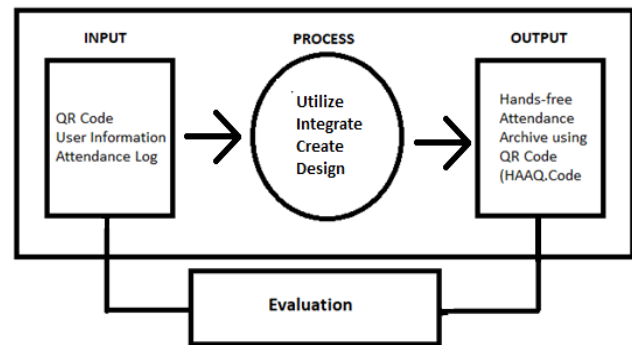


Fig 1. Input-Process-Output Diagram

1.4 Significance of the Study

The following are expected to benefit from the Hands-free Attendance Archive using QR Code system:

Faculty and Staff. The system will eliminate the need for the faculty and staff to manually write their daily attendance record on a logbook, and manually retrieve it again at the end of every month. The system will also address the need for an attendance system that adheres to strict physical distancing protocols.

Health Protocol Personnel. The system eliminates the need to physically write on a log book for attendance. Hence, health protocol personnel who maintain social distancing and physical contact protocols will benefit from the system.

Future Researchers. This study will benefit future researchers in developing a system that can help give them an idea and basis to their future project.

1.5 Scope and Limitation

This study was limited to the development of the Hands-free Attendance Archive System. The study will use a descriptive-developmental research design. The system will be limited to just two types of users. First is the Admin, which will be responsible for generating QR codes, as well as creating, retrieving, updating, printing, and deleting, user data from the database. The second type is User, which will be limited only to logging of individual attendance using QR code.

This study utilized the standardize questionnaire checklist developed by John Brooke in order to determine the usability of the system. The data gathered from respondents will be tabulated and analyzed using the System Usability Score.

This study was conducted at the Iloilo State College of Fisheries – San Enrique Campus, San Enrique, Iloilo.

1.6 Definition of Terms

The following terms used in this study are defined to ensure clarity and better understanding:

Attendance. Attendance means the act or fact of attending something or someone. (Merriam-Webster, 2022)

In this study, attendance refers to the daily log data of the user which will be retrieved using QR Code and saved into the database.

HAAQ.Code. Hands-free Attendance Archive using QR Code. HAAQ.Code refers to the completed system that utilizes QR Code to log and retrieve user attendance data.

Hands-free. Hands-Free means designed to be used without being held in the hands. (Merriam-Webster, 2022)

In this study, hands-free refers to the concept as to how users will interact with the system.

QR Code. A QR code is a pattern of black and white squares that can be read by a smart phone, allowing the phone user to get more information about something. QR code is an abbreviation for 'Quick Response code'.

(Collins Dictionary, 2022).

In this study, the QR Code will serve as the medium that will hold user information. It is used to automatically scan and log the user's attendance into a database.

Usability. Usability refers to the quality of a user's experience when interacting with products or systems, including websites, software, devices, or applications. Usability is concerned with effectiveness, efficiency, and overall satisfaction. (usability.gov, 2022).

In this study, usability refers to the usefulness of the system to its users.

2. Literature Review

Measuring School Absenteeism: Administrative Attendance Data Collected by Schools Differ From Self-Reports in Systematic Ways

School absenteeism is widely considered as one of the scourges not only to young people and students, but it also affects those in the working class where it has been proven several times that it can affect production. This study (Keppens, et.al.,2019) have found out, albeit in a lesser degree, that absenteeism does have a correlation to student performance. The study used two variables: self-reported unauthorized school absenteeism and registered authorized school absenteeism.

Although the study focused mainly on how absenteeism is reported among its respondents, it does highlight the fact that absenteeism does have a profound impact on people. It is also important to note that the researchers used manual attendance logs in the conduct of the study. The researchers noted that if an alternative system would have been used, there might be some changes as with regards to the data that they have gathered and analyzed.

Students Perspective on Attendance Monitoring in Undergraduate Obstetrics and Gynecology

Several studies have conclude that attendance monitoring has a measured effect in terms of student performance. Not only does it compels students to attend their classes, but it has an indirect effect on their overall performance. While attendance alone does have an effect on student academic performance, one of the many factors studies have pointed out was the manner of how these attendances are taken. While logbooks are some of the most common, many have deemed them unnecessary, and sometimes borderline useless.

In the age of Information Technology, people, especially young students, are more geared towards the digitalization of attendance monitoring. Not only does it make the process easier for the students, it also allows those who are tasked of monitoring it to easily pore over attendance details without having to manually peruse a logbook.

This study (Bamania, P., et.al., 2017) measured the perspective of its respondents with regards to the monitoring of their attendances. The study's respondents was only limited to the obstetrics and gynecology. Nevertheless, the findings was quite interesting, especially on the point of attendance monitoring. The study concluded that the respondents feel positive about the need to have their attendance monitored, especially that they are working on the medical field and time is always of the essence. Moreover, the study highlighted the fact that while students are enthusiastic about the need for attendance monitoring, the medium as to how it was done, which is to say manually, did not sit well with them. The researchers have concluded that the 'pen and paper' approach to attendance monitor is quite dated, and that institutions should start adopting electronic systems in attendance monitoring.

Examining the Impact of QR Codes on Purchase Intention and Customer Satisfaction on the Basis of Perceived Flow

After its invention in 1994, QR Codes have languished in relative obscurity due to its quite demanding hardware requirement. In an era when QR Codes scanners cost quite a fortune, this medium of data transfer was not well-received. Fast forward to the era of smartphones and the unprecedented rise of the Internet, QR Code has finally found its calling.

In today's world, the utilization of QR code is ubiquitous, almost to a zeitgeist degree. In countries like China, Brazil, and Mexico, QR Code is one of the primary means of payment and the medium is embedded on almost every aspect of the people's daily lives. Even in the Philippines, the use of QR Code is slowly rising, and it has even come to the point that the government used it for the verification of vaccination certificates.

Before its proliferation in the previously mentioned instances, QR Code has enjoyed quite a success although in limited test cases. This study (Hossain, M. S., et.al, 2018) has concluded that the use of QR Code has a direct impact in consumer purchase intentions and satisfactions. The study found out that QR Code can influence perceived flow, which in turn affects shoppers' satisfaction, and finally purchase intention. Additionally, the study concluded that when QR Codes are utilized in advertising, it makes it easy for marketers to reach out to possible customers since QR Codes are far easier to embed into a product compared to leaflets and other mediums of advertising.

A QR Code-Based Contact Tracing Framework for Sustainable Containment of COVID-19: Evaluation of an Approach to Assist the Return to Normal Activity

Since COVID-19 has been proven to be extremely infectious, many controls and measures have been used in order to limit the spread of the virus. Once such measure is to maintain physical distancing and limit physical contact. Another approach is contact tracing, which involves identifying, quarantining, and alerting contacts of infected individuals.

Traditional contact tracing methods usually involve having people fill-up paper documents and physically contacting them. Although this method has been proven to be effective in the past, it poses a big risk because of the physical contact between people.

In order to maintain physical distancing and limit physical contact, one of the many approaches used by many countries is to deploy digital scanning and contact tracing methods. This strategy has been proven to be extremely effective since it limits the physical contact between people.

Due to the ubiquity of smartphones, most contact tracing strategies use this device to implement their contact tracing strategies. Some of the most common methods involve using Bluetooth, GPS (Global Positioning System), and Quick Response (QR) codes technology. While these methods are effective, it is important to note that not all people own a smartphone. As such, Bluetooth and GPS technologies are only limited to individual who own such devices.

On the other hand, a QR Code can be printed on a piece of paper. Such code can contain an individual's complete information. The code can be scanned by health inspectors and quarantine officials, and then verify it from the database.

This study (Nakamoto, I., et.al 2020) have concluded that using a QR Code-based system substantially controlled the spread of COVID-19 in the Fujian Province in China. Since QR Codes can be scanned from a distance, users can maintain physical distancing and contact.

COVID-19 Case and Contact Tracing: Policy Learning from International Comparisons

Throughout the COVID-19 epidemic, case and contact tracing in Taiwan have been conducted along with the use of already existent or updated technological resources. This study (Bhatia, D., et.al., 2020) found out that contact tracing is highly effective if proper technological strategies are applied. One such practice pointed out by the study is Taiwan's technological approach to contact tracing, wherein the government used a QR code system in order to gather data. These QR codes are then being scanned in various buildings and places in order to log that the user entered or left it. Through this intensive logging system, government and health officials can easily trace the route of a particular person should he or she contacted COVID-19.

The Use of QR Codes to Identify COVID-19 Contacts and the Role of Data Trust and Data Privacy

This study (Biddle, 2021) used the Test-Trace-Isolate process as a non-medical response to the COVID-19 pandemic. This study proved that the use of QR codes in tracing those who come in contact with a person who contacted COVID-19 is effective. Each person is enrolled into a database system and is assigned with a unique QR code. Each person is then required to have this QR code signed every time they enter or leave a building, and also in public and open spaces.

However, the study also discussed some possible violations of privacy. The study argue that the data stored can be used to trace people for non-pandemic purposes.

Student Attendance System using QR Codes (Case Study: Institut Teknologi Telko Surabaya)

Student attendance is needed in order to measure the level of participation of each student. However, old practices like manual logging in an attendance log sheet is tedious and redundant. Additionally, retrieving data from these paper copies also uses up a lot of time which could have been used in classroom instructions.

This study (Rahmawati, D., et.al., 2019) have found out that utilizing QR Codes in taking student attendance saves a lot of time and effort. By saving these records into a database, it makes it easier for teachers to retrieve attendance logs for later analysis and usage

The Features of Quick Response (QR) Code as an Attendance Monitoring System: Its Acceptability and Implications to Classroom

The current study has found parallels to this study (Carreon, J., et.al., 2018). The goal was to determine the feature that makes QR Codes efficient when used as an attendance monitor tool. It also aimed to develop a system that will utilize a system that will utilize QR Code in taking student

attendance and assess its acceptability to its respondents. This study used a descriptive-developmental approach.

The similarities of the study cited to the present study are the use of QR Code for taking attendance and the utilization of a database for storing and retrieving data.

The difference between the cited study to the present study are the scope and the evaluation used to the respondents. The former measured the reliability, efficiency, accuracy, usability, and security of the developed system, while the latter measured the usability of the developed system.

3. Methodology

3.1 Research Design

This study employed the descriptive-developmental method of research. The descriptive aspect of the study aimed to accurately and systematically describe a population, situation, or phenomenon. The developmental aspect aimed to design, develop, evaluate, and implement a system that will meet the objectives of the study.

Python 3.7, the PyCharm 2022 Community Edition IDE, and LAMP stack were used to develop the software component of the system. The Raspberry Pi 4 and QR Code scanner served as the hardware component of the system.

3.2 System Development Life Cycle

The researcher used the principles of the System Development Life Cycle. Specifically, the researcher used the SDLC Waterfall Model.

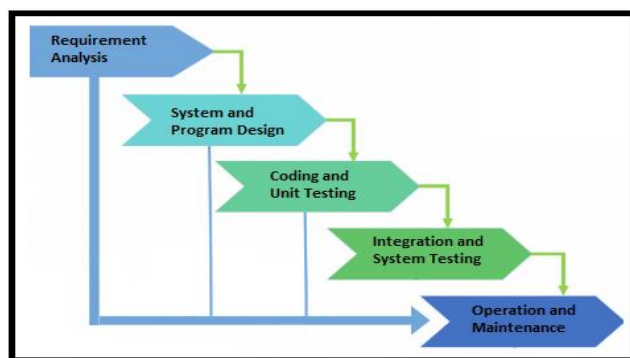


Fig 2. System Development Life Cycle – Waterfall Method (SDLC)

This study utilized the System Development Life Cycle – Waterfall Method developed by Pressman (2010). It is composed of five phases: Requirement Analysis, System and Program Design, Coding and Unit Testing, Integration and System Testing, and Operation and Maintenance.

3.3 Overview of Phases

The study used the TeamGantt management tool as a guide in project development. Using the Waterfall model, the study went through five phases. The researcher followed the five stages of the Waterfall model in order to plan and

execute the specific tasks for each phase. The detail discussion and description for each phase are explained as follows:

3.4 Requirement Analysis Phase

During this phase, the researcher conducted document sampling. The researcher gathered documentary samples like Civil Service Form 48, also known as Daily Time Record or DTR, from individual faculty and staff of Iloilo State College of Fisheries – San Enrique Campus. Other documentary samples like attendance log books were also utilized during this phase.

The researcher also checked the Institution’s various business rules and practices when it comes to logging of individual attendances of the faculty and staff. This is to make sure that the developed system will adhere to these rules and practices, and not impede the accepted normality within the Institution.

To collect further data, the researcher conducted interview with the faculty and staff of the Institution in order to gauge their perception regarding the current mode of attendance logging and retrieval in the Institution.

The researcher also conducted visual observation of the current mode of attendance logging and retrieval in the Institution. By doing so, the researcher was able to perceive some basic functionalities of the developed system and designed it in such a way that it will imitate the current mode of attendance logging so as not to intimidate the users when using a digital attendance system.

During this phase, the researcher also determined what software and hardware components are to be used in the design and development of the system.

3.4.1 Software Requirement.

For the design and development of the system, the researcher used Python 3.7 as the core programming language. The Python programming language was selected for this study as the researcher is mostly familiar with it compared to other contemporary programming languages. Moreover, the Python programming language has a wide array of libraries that can be utilized for generating QR Codes, designing user-interface, and managing databases.

The PyCharm 2022 Community IDE was utilized in writing the code. This particular IDE was used since it is the most widely used Python IDE. Moreover, it has multiple features like packages and libraries management, project management, and internal interpreter that makes the entire coding and development cycle bearable for the researcher.

The Raspbian distribution of the Linux operating system was used as the operating system of the Raspberry Pi 4. The Raspbian version used for the development and implementation of this study was the 32-bit version released

on April 4, 2022, with a kernel version of 5.15 and runs on the Debian 11 version called Bullseye.

Furthermore, the Linux, Apache, MariaDB, PHP (LAMP) stack was utilized for the back-end and database development. This particular stack was chosen since the researcher used the Raspbian distribution of the Linux operating system. For this particular study, the researcher used LAMP version 8.1.7.

During the implementation of the system, a monitor with at least a 1920x1080 resolution must be utilized due to GUI design constraints.

3.4.2 Hardware Requirement.

For the design and development of the system, the researcher used a personal computer with a Ryzen 5 2600x processor, 16GB of RAM, 1TB of storage, and 4GB of video memory.

During the implementation of the system, the researcher used a Raspberry Pi 4B with 4GB of RAM and a QR Code scanner. A printer was also utilized in order to print individual QR Codes and attendance logs.

3.5 System and Program Design Phase

During this phase, the user used prototype, activity diagram, class diagram, block diagram, deployment diagram, and use case diagram in order to help in the design and development of the system. A pen-and-paper prototype was created in order to have a visual representation of the final project.

3.5.1 Use Case Diagram

This study used a Use Case Diagram in order to describe how the User and Admin interacts with the system. It described and signified an interaction over time that has meaning for end user (person, machine or other system). The Use Case Diagram (Figure 3) showed that the Admin have access to the following functionalities: register user, update user information, delete user, print QR code, and print attendance logs. On the other hand, the User only has access to the Attendance Log functionality.

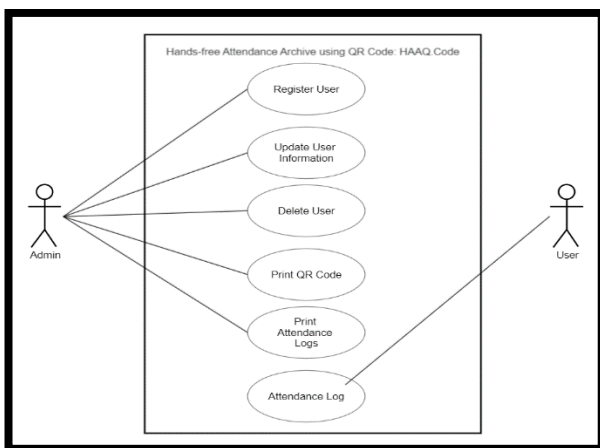


Fig 3. The Use Case Diagram of HAAQ.Code

3.5.2 Activity Diagram.

This study used an activity diagram in order to display the sequence of activities. Activity diagram showed the work flow from start to finish. It provided a detailed decision path that exists in the progression of events contained in the system.

The diagram (Figure 4) showed a detailed visual description of the actions the user can perform when interacting with the system. First, the user must check if they have a QR code. In case they do not have one, they can contact Admin to generate one for them. In case that they have a QR code, they can proceed to the scanner and scan it. If the QR Code is invalid, the user must check with the Admin for any irregularities. If the QR Code is valid, the user can choose whether they are logging in or logging out.

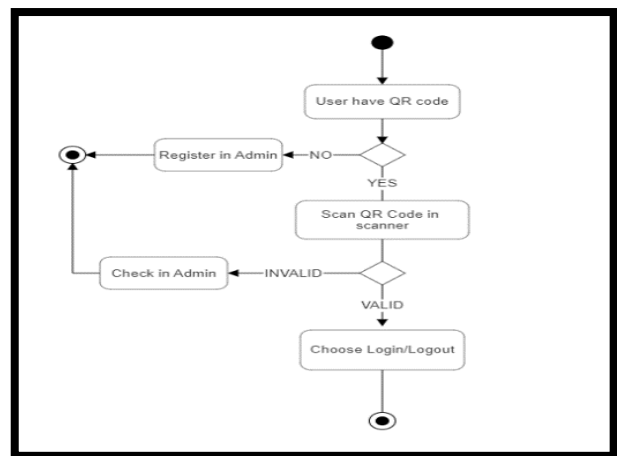


Fig 4. Activity Diagram for User of HAAQ.Code

The Activity Diagram for Admin (Figure 5) showed a detailed visual description of the actions Admin can perform when interacting with the system. First, the Admin will have to provide valid login information. If it is valid, it will gain access into the system and can access its functionalities including register new user, print QR Code, update user information, delete user, and print attendance logs.

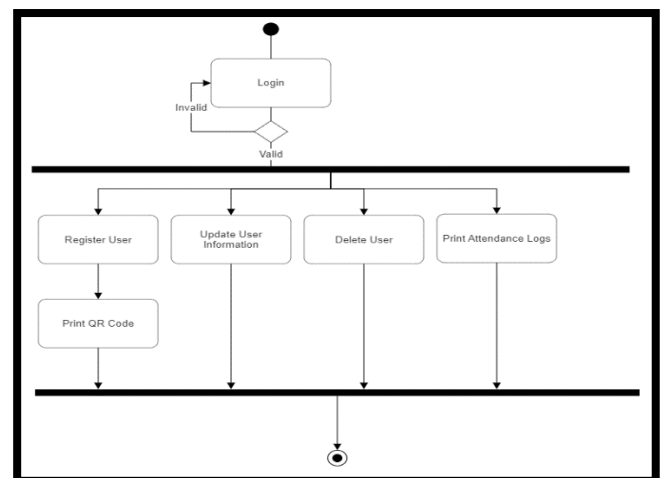


Fig 5. Activity Diagram for Admin of HAAQ.Code.

3.5.3 Class Diagram

This study used a Class Diagram in order to provide a conceptual model of the attributes and operations in the system. The Class Diagram mapped out the structure of the system, as well as the relationships of objects and functions. The class diagram of the system visualizes the classes, attributes, and relationships between different data sets in the database.

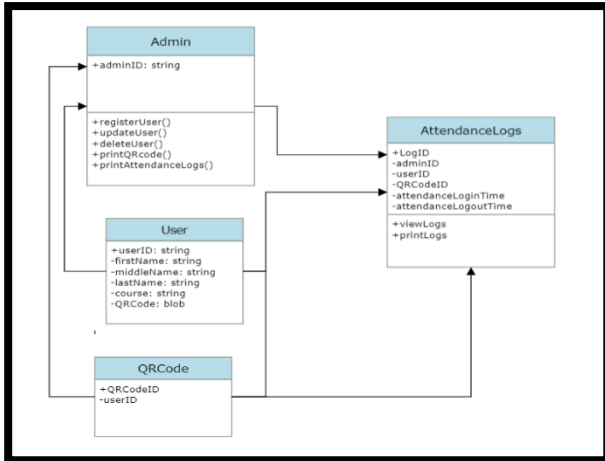


Fig 6. Class Diagram of HAAQ.Code

3.5.4 Deployment Diagram.

This study used a Deployment Diagram in order to show the execution architecture of a system. The diagram included nodes like hardware and software execution environments, as well as the middleware that connects the two. The deployment diagram is used to visualize the physical hardware and software components of the system. In the Deployment Diagram the user used a QR code and scan it on the QR code scanner. The data gathered will then be forwarded into the Raspberry Pi 4b and checked in the database. Once the QR code is confirmed to be valid, an attendance log will be saved in the database.

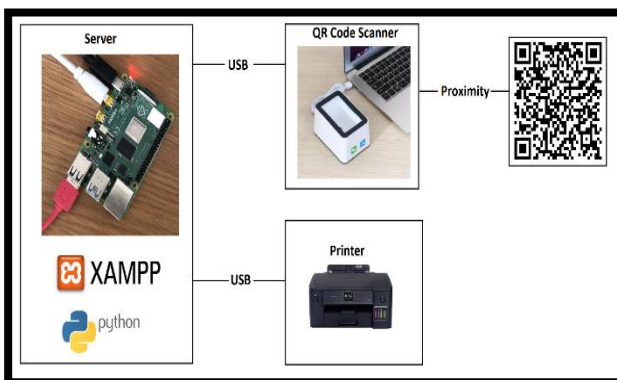


Fig 7. The Deployment Diagram of HAAQ.Code

3.5.5 Block Diagram.

This study used a Block Diagram (Figure 8) in order to visualize the principal parts and functions that are present in the system. These are connected by lines in order to show

the relationship of the blocks. The Block Diagram is composed of three hardware components: a Raspberry Pi 4B, QR code scanner, and a printer. The Raspberry Pi 4B hosted the database and the database admin application. The QR code scanner was responsible for scanning the QR code given to each user. The printer was used to print a QR code for each user, and the attendance log.

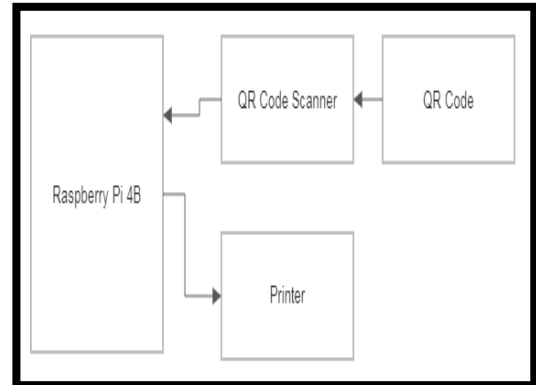


Fig 8. Block Diagram of HAAQ.Code

3.6 Coding and Unit Testing

During this phase, the researcher followed four major sub-tasks. These tasks are Front-End Implementation, Database Implementation, Back-end Implementation.

For the Front-End Implementation, the researcher used the Python Tkinter interface for the Tcl/Tk GUI toolkit. It was also during this phase that the researcher designed the GUI interface for the user and the GUI interface for the admin.

For the Database Implementation, the research used the LAMP stack for development and implementation and the database and back-end interface of the system.

For the Back-end Implementation, the researcher used the PHP component of the LAMP stack in order to create the database and its tables. As for the Create, Read, Update, and Delete functionalities of the database, the researcher used the PyMySQL library of the Python programming language in order to interface with the LAMP stack.

3.7 Integration and System Testing

During this phase, the researcher sought out the expertise of one MIS officer and one IT technician. Three tests were performed: Whitebox Testing, Blackbox Testing, and User Acceptability Testing. Two sets of respondents were picked during this phase. The first set is composed of one MIS Officer and one IT technician, and they served as the QA Testers of the system. They were purposively picked to perform Whitebox Testing and Blackbox Testing. The other set of respondents are thirty-six (36) faculty and staff of Iloilo State College of Fisheries – San Enrique Campus who were randomly picked. The population of this set of respondents were determined using the Slovin's method with a 10% margin of error.

For Whitebox Testing, the system was tested by entering valid inputs. A Test was drafted, test criteria were decided upon, system features to be tested are identified and test design identifier were determined.

For Blackbox Testing, invalid inputs were given to the system in order to test its functionality. A QA Tester Log was drafted and used to aid the tester in testing the functionality of the system.

Finally, for the User Acceptability Testing, test questions were drafted, respondents were picked, and the usability test was administered. The researcher drafted a letter asking permission from the Institution's Campus Administrator asking permission to conduct the test. Finally, the results were analyzed and interpreted.

3.8 Operation and Maintenance

During this phase, the researcher determined four major tasks. These are Training and Dissemination, Documentation, User Support, and Enhancements.

The Training and Dissemination task involved training users on how to manipulate and navigate the system. Separate trainings will be conducted for ordinary users and system administrators. Permission from proper authorities will be sought and training module will be prepared for this task.

The Documentation task is the most daunting of the four as it requires proper document and photo documentation all throughout the design, development, and implementation of the system. Nevertheless, this will be properly organized with respect to the time determined at the Work Breakdown Structure (Appendix E).

During User Support, a User Manual (Appendix F) was drafted as a reference for users on the key functionalities of the system as well as how the system is to be operated properly.

The Enhancement task will involve getting feedbacks from user. The researcher will analyze these feedbacks and determine whether it will be useful to the system. If it is deemed useful, the researcher will consider upgrading the system to further enhance its functionalities.

3.9 Locale of the Study

This study was conducted at the Iloilo State College of Fisheries – San Enrique Campus, San Enrique, Iloilo. ISCOF-SEC is located in the municipality of San Enrique (Appendix F). It is one of the five external campuses of the ISCOF System.

3.10 Respondents of the Study

The respondents of the study who evaluated the system in terms of its usability are thirty-six (36) faculty and staff of the Iloilo State College of Fisheries – San Enrique Campus who were randomly chosen.

3.11 Sampling Technique

The researcher used purposive sampling in choosing the HR designate and staff. They will serve as the system administrators. While random sampling was used in choosing the respondents who served as users of the attendance logging system. These respondents were chosen based on their availability.

3.12 Research Instrument

The researcher used the standardized questionnaire checklist of John Brooke (1986) in evaluating the usability of the system. The questionnaire checklist is composed of ten (10) statements. The system's usability was evaluated using the System Usability Scale with the descriptive rating of strongly agree, agree, neutral, disagree, strongly disagree. On the rating scale for items 1,3,5,7, and 9 the score contribution is the scale position minus 1. For items 2,4,6,8 and 10, the contribution is 5 minus the scale position.

Table 2. This is the rating scale used to evaluate the system's usability

	Scale	Numerical Rating
5	Strongly Agree	5 points
4	Agree	4 points
3	Neutral	3 points
2	Disagree	2 points
1	Strongly Disagree	1 point

3.13 Data Gathering Procedure

Before the start of the design and development of the system, the researcher gathered preliminary data using document sampling, determining business rules, conducting interview, and observing practices.

After the needed data were gathered and analyzed, the researcher drafted a system flowchart which served as the primary pattern in the design and development of the system.

The system was developed using the SDLC – Waterfall Method.

After the system was developed, it was evaluated by thirty-six (36) faculty and staff of the Iloilo State College of Fisheries – San Enrique Campus. During the evaluation of the system, the researcher installed the system at the Administrative Building. The respondents were informed about how to interact with the system, and were allowed to operate the system. The researcher handed out an evaluation sheet for evaluation.

3.14 Data Analysis and Procedure

The data gathered was subjected to appropriate descriptive statistical tools. In evaluating the usability of the application, the gathered points were tabulated and analyzed using the System Usability Score. The formula in computing the SUS is:

$$SUS=(X+Y) \times 2.5$$

Where:

X= the points for odd-numbered questions – 5

Y= 25 - the points for even-numbered questions

In interpreting the result of the data gathered in evaluating the system’s usability, the researchers solved for the average score and in interpreting the system’s usability, the following table was used:

Table 1. Percentiles grades, adjectives, and NPS categories to describe raw SUS scores.

X	SUS	Percentile Range	Adjective	Acceptability	NPS
A+	84.1-100	96 – 100	Best Imaginable	Acceptable	Promoter
A	80.8-84.0	90 – 95	Excellent	Acceptable	Promoter
A-	78.9-80.9	85 – 89		Acceptable	Promoter
B+	77.2-77.8	80 – 84		Acceptable	Promoter
B	74.1-77.1	70 – 79		Acceptable	Passive
B-	72.6-74.0	65 -49		Acceptable	Passive
C+	71.1-72.5	60 – 64	Good	Acceptable	Passive
C	65.0-71.0	41 – 59		Marginal	Passive
C-	62.7-64.9	35 – 40		Marginal	Passive
D	51.7-62.6	15 – 34	OK	Marginal	Detractor
E	25.1-51.6	2 – 14	Poor	Not Acceptable	Detractor
F	0-25	0 – 13		Not Acceptable	Detractor

4. Results And Discussion

4.1 Results Hands-free Attendance Archive Development

This will discuss and visualize the result of the design and development process of the Hands-free Attendance Archive using QR.Code.

4.1.1 Utilize QR Code Scanner in Generating Attendance Logs for Attendance Archive

In order to keep the user-interface as simple as possible for the users, the researcher designed it in such a way that its main function can be accessed by simply scanning a QR

Code. Figure 10 shows the exact replica of what each user’s QR Code will look like. Each user is provide with their own unique QR Code so that they can easily log their attendance into the system. Moreover, a QR Code scanner is connected into the system so that users can easily scan their respective QR Codes and have their attendance logged into the system’s database.

4.1.2 Integrate a Raspberry Pi 4 and QR Code Scanner Into the System

In order for the Hands-free Attendance Archive using QR Code system to fully function, the integration of a Raspberry Pi 4 and a QR Code scanner is needed. The Raspberry Pi 4 will be responsible for running the user interface and

keeping the database, while the QR Code scanner is needed to scan QR Codes. The Raspberry Pi 4 used in the system has a Quad-core Cortex-A72 processor clocked at 1.5GHz. It has 4GB of memory, and a 64GB microSD card for storage. For the system to be able to scan QR Codes, a generic flatbed QR Code scanner was integrated. The QR Code scanner has an auto-paste feature and it is connected to the Raspberry Pi 4 using the USB port.

4.1.3 Create a Database for the Attendance Archive

For the system to be able to store, update, delete, and retrieve user information, a database must be created. With regards to this, the researcher utilized the LAMP stack since the Raspberry Pi runs on the Raspbian distribution of Linux. Apache was installed and served as the server. MariaDB was installed as the database. PHP was installed and was used to interact with the database and the user-interface. The HAAQ.Code database was created, along with its tables, in order to store user data and attendance logs.

4.1.4 Design a User-Interface for the Attendance Archive

For users to be able to interact with the system, Graphical User Interface (GUI) was developed by the researcher. On that note, the user-interface was designed in such a way that it will not intimidate users into using it. Especially those who are not technically inclined. Figure 16 is the HAAQ.Code dashboard. It is the only interface that users of the system will interact with. In order to keep the system simple, the researcher designed the user interface in a way that users will only have to scan their respective QR Code and the system will be responsible for determining the log status (login or logout), time, and which user is trying to log into the system. That way, all the user has to do is scan their respective QR Code, and the system will do the rest for them.

4.1.5 Admin Interface

The admin user will be responsible and has access to the major functionalities of the system. The admin will be capable of adding of new users, updating user information, deleting user data, generating QR codes, printing QR codes, and printing attendance logs. Before the admin can interact with these functionalities, the admin first must login.

4.1.6 Create New User and Generate QR Code

Before users can interact with the system, they must have a valid QR Code. For them to have one, their user information must first be entered into the system's database, and only then can a QR Code will be generated and printed for them.

A user registration and QR code generation window was created. It requires three entries: First Name, Middle Name, and Last Name. Once these entries are filled, the user has to press the Generate QR button to generate the QR code. The upload button will allow admin to upload a photo of the user. The Save button will save the entered data into the database.

The Print button will print the QR code of the user. The admin user will be responsible for entering all the necessary information into the system, generate a QR code, save the data into the database, and print the QR code for the user.

4.1.7 Update User Information and Generate Lost QR code

There will come a time when users will need to have their information updated. For this reason, the researcher added an update functionality into the system. There will also come a time when users will lost their QR Code and have one generated again for them. In order to keep the system as simple as possible, the researcher designed it in a way that these two functionalities are embedded into a single window.

The update user information and QR Generation window has a search button for the admin to be able to search user information from the database (Figure 19). The admin only need to supply at least one of the entry widget to search for the user. In case there are duplicates, the system will notify the user to narrow down their search option by filling another entry widget.

Once a user is searched, the admin can then update their information, generate a new QR Code for them, and then update their data on the database.

This window also serves as a QR Code generation window for users who need to have their QR Code re-printed in case they lost it. For this purpose, the admin only needs to search the user's profile, and then print the QR Code again for them.

4.1.8 Delete User

Only the admin user has the authority to delete users in the database. For the admin user to be able to do this, the researcher added the Delete User functionality into the system.

The Delete User Information window only has two buttons. One is to search the user that will be deleted from the database. The other one is the delete button, which will remove the user data from the database when pressed. The admin only needs to supply data to at least two entries for them to be able to search the user that they want to be deleted from the database.

4.1.9 Print Attendance Logs

One of the core functionalities of the system is the option to print attendance logs for a specific month and year. To search for a record, the admin will only have to provide at least two of the entries and then click Search. The system will search the database and then preview the data collected on the table.

4.1.10 Attendance Log Output

The selected attendance log will be printed to an A4 size bond paper. The attendance log of the selected user will be entered into the approved CSC Form 48 template before printing.

4.2 Evaluation on the Usability of the Developed Hands-free Attendance Archive using QR Code

The Hands-free Attendance Archive using QR Code was evaluated by thirty-six (36) faculty and staff of the Iloilo State College of Fisheries – San Enrique Campus who were randomly chosen. Random sampling was used in choosing the respondents who served as users of the attendance logging system. The respondents were chosen based on their availability.

The results show that the system got a grand System Usability Mean of 95.20833. This means that it is graded A+, within the 96-100 Percentile Range, described as “Best Imaginable”, “Acceptable”, and “Promoter” which means that the respondents will promote the evaluated system.

Gb/in².” An exception is when English units are used as identifiers in trade, such as “3½ in disk drive.” Avoid combining SI and CGS units, such as current in amperes and magnetic field in oversteps. This often leads to confusion because equations do not balance dimensionally. If you must use mixed units, clearly state the units for each quantity in an equation.

The SI unit for magnetic field strength H is A/m. However, if you wish to use units of T, either refer to magnetic flux density B or magnetic field strength symbolized as $\mu_0 H$. Use the center dot to separate compound units, e.g., “A·m².”

5. Summary, Conclusions, and Recommendation

Summary

The Hands-free Attendance Archive using QR Code system is a descriptive-developmental research. Its objectives are to design and develop a hands-free attendance logging system that uses QR Code, integrate a Raspberry Pi 4 and QR Code scanner into the system, and determine its acceptability in terms of usability. On the software side of the development, the researcher used Python 3.7 as the core programming language, while PyCharm 2022 Community IDE was utilized in writing the code. Furthermore, the Linux, Apache, MariaDB, and PHP (LAMP) stack was utilized for the back-end and database development. The Raspbian distribution of the Linux operating system was used as the operating system of the Raspberry Pi 4. On the hardware side, the researcher used a personal computer with a Ryzen 5 2600x processor, 16GB of RAM, 1TB of storage, and 4GB of video memory. During the implementation of the system, the researcher used a Raspberry Pi 4B with 4GB of RAM and a QR Code scanner. A printer was also utilized in order

to print individual QR Codes and attendance logs. The Hands-free Attendance Archive using QR Code was evaluated by thirty-six (36) faculty and staff of the Iloilo State College of Fisheries – San Enrique Campus who were randomly chosen. Random sampling was used in choosing the respondents who served as users of the attendance logging system. The respondents were chosen based on their availability. After the system was developed, it was tested and evaluated for its usability. It was made by distributing the questionnaire checklist of John Brooke (1986). The data were subsequently analyzed using the system usability score. The study was conducted at the Iloilo State College of Fisheries – San Enrique Campus.

Findings

The findings of the study revealed that:

1. a QR Code scanner was utilized in generating attendance logs for the attendance archive;
2. the Raspberry Pi 4 was integrated into the attendance archive;
3. a database was created to store, update, delete, and retrieve data from the attendance archive;
4. user-interface was designed so that users can interact with the attendance archive;
5. the system got a SUS score of 95.20833 which means it was grade A+, within the 96-100 Percentile Range, described as “Best Imaginable”, “Acceptable” as to its acceptability, and got a Net Promoter Score described as Promoter.

Conclusion

Based on the results and findings of the study, the Hands-free Attendance Archive using QR Code was grade A+ in terms of usability. This means that it is within the 96-100 Percentile Range. It is described as “Best Imaginable”, “Acceptable” as to its acceptability. It also got a Net Promoter score described as Promoter, which means that the respondents will promote the system.

Recommendations

1. The Iloilo State College of Fisheries – San Enrique Campus may use the Hands-free Attendance Archive using QR Code for the implementation of a hands-free attendance logging of faculty and staff.
2. The Raspberry Pi 4 and QR Code scanner are vital components in the implementation of the Hands-free Attendance Archive using QR Code.
3. The future researchers who will conduct the same study may improve, add more features, and update the contents included in the student handbook.

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